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Identification of occupational risk factors by interviewing injured workers in an out-patient clinic

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Abstract

Background: To prevent injuries, identification of the involved risk factors is necessary. Two recent in-depth investigations were carried out in the health service of Oslo on workers seeking treatment of severe occupational injuries. The interviews were rather time-consuming, and hence rather costly. The aim of the present study was to find a less time-consuming method which nevertheless would identify preventable risk factors.

Methods: In-depth investigations of 15 injuries with nail guns and 28 injuries related to scaffolding were conducted in an out-patient clinic in Trondheim, Norway. Patients were interviewed by health personnel just before or after the treatment based on specifically designed questionnaires. A group of specialists analysed the information collected.

Results: Some risk factors were identified: design weaknesses inherent in nail guns, presence of snow and ice at the injury location, foreign body in the eye and lack of control/inspection of scaffolding when erected. On average, about two man hours were used for each injury. The most relevant questions were those directly related to the narrative, in particular how the injury occurred, and if any special conditions were involved. Quite a few data elements require epidemiological representative studies in order to assess them as potential risk factors.

Conclusions: This relatively low time-consuming method revealed some risk factors. However, it could be more effective if the interviews were conducted by telephone a few days after the treatment by a specialist in that particular injury type; such as an experienced labour inspector, in order to probe more deeply into the technical risk factors.

Key words: in-depth investigation, occupational risk factors, nail gun, scaffoldings

Introduction

To prevent injuries, identification of the risk factors involved is necessary. A risk factor can be defined as "an aspect of personal behaviour or life-style, an environmental exposure, or an inborn or inherited characteristic, that, on the basis of epidemiologic evidence, is known to be associated with health-related condition(s) considered important to prevent" [1]. For prevention, involved risk factors have to be removed or modified or humans have to be trained or instructed in how to avoid or overcome them [2]. Interviewing the injured persons as soon as possible after the injury regarding the circumstances under which it occurred and on various aspects of the injury event is one way of identifying risk factors.

The National Health Service is normally a more comprehensive source for contacting injured workers. The official occupational injury registration system may have a rather high level of underreporting and rather high level of reporting delays. In Norway, approximately three times as many injured workers are treated by the National Health Service as the number registered by the occupational authorities and it might take 1-2 years before the injury is reported [3].

The routine data collected by the health service from injured workers is often too scarce to identify risk factors. Therefore, additional data must be collected. This can be done in specially designed interviews with extra personnel. We will call them "in-depth investigations". There are many examples of such in-depth investigations. In one study, 45 in-depth investigations over a period of 30-40 years in the Nordic countries

utilising the health services were identified [4].

Two in-depth investigations on occupational injuries were carried out in Oslo during 2001-2003. In the first, 223 persons treated for all types of severe occupational injuries at the Oslo Accident and Emergency Department and Ambulance Service over a period of three months were interviewed. A severe injury is defined by the labour authorities and must be reported by telephone for a possible inspection. Examples of severe injures are: concussion, fractures (except minor ones), injuries that require hospitalisation.

The interview lasted approximately thirty minutes, and was based on a structured questionnaire. The interview was conducted by a physician, specifically dedicated to this work [5]. In this study, very few risk factors were identified due to too few details in the answers and narratives collected.

In the second investigation, fifty workers in the construction industry with severe occupational injuries were interviewed after the treatment by a semi-structured questionnaire lasting about one hour [6]. In approximately half the cases, the physician conducted on-site investigations, at times paired with a trained labour inspector, reconstructed the injuries, took photographs and interviewed workers and foremen. A group of experts (5-6 persons) studying and analysing the injury reports revealed quite a few risk factors. Forty-two preventive measures were identified and sent to the relevant authorities for consideration. This last in-depth investigation was effective with regard to identifying preventive measures, but was relatively time-consuming: 2-3 man-days per injury.

The aim of the present study was to:

1) find a less time-consuming method for in-depth investigation of occupational injuries utilising the health system, but which would nevertheless identify risk factors as a base for proposing preventive measures,
2) test the relevance of each question (or data element) in the developed questionnaire for identification of risk factors.

Methods and material

This study was designed to collect qualitative data on occupational injuries from workers treated in an out-patient clinic by means of a questionnaire. Especially hired personnel interviewed the workers. The collected data was later analysed by an expert group for identifying preventable risk factors. This qualitative design required no statistical methods for the analyses.

The study was part of a pilot-test of a new injury register that took place at the state-owned hospital and the municipality-owned out-patient clinic in Trondheim during the years 2007-2008. These two health institutions are located in the same building. They serve a population of approximately 200,000. Based on a study in Trondheim during 2007 (data not published) it is assessed that 70-80% of all medically treated injuries in that population are treated at those two institutions, the rest are treated by general practitioners and occupational health practitioners in the city and surrounding municipalities.

It was a two-step medically-based injury register that was pilot-tested in Trondheim [7]. The first step was to monitor the amount of the main injury types. A Minimum Data Set [8] is collected for all injury patients by reception personnel at the hospital and the out-patient clinic in the routine without extra cost [9]. The second step was to carry out periodic in-depth investigations with an Expanded Data Set that might take the form of a questionnaire. These two steps were not necessarily dependent on each other, they can exist separately. This study was the test of such a second step.

Based on ongoing work in the Norwegian Labour Inspection Authorities two types of occupational injuries were chosen for testing this method of in-depth investigation: 1) injuries with nail guns and 2) injuries where scaffolding was involved. One questionnaire specific to each type of injury was developed in collaboration with labour inspectors with the necessary experience and expertise. Most of the questions were similar in the two questionnaires listed in Box 1. In Box 2 the questions specific to injuries with nail guns or with scaffolding are listed. An interview guide was developed, focusing on how to phrase questions in order to identify risk factors and root causes.

Three health nurses and assistant nurses were specifically hired for the process of testing the new injury register. For monitoring purposes, the reception personnel in the out-patient clinic were given explicit instructions and the data quality was checked, especially the completeness of the questionnaire. For the in-depth investigations, the especially hired personnel carried out the interviews. By means of an interview guide, they were instructed in the interviewing by one of the authors (TL), in particular with regard to capturing as many details as possible in the narratives. Patients injured in relation to a nail gun or by scaffolding were asked to come to a separate room to be interviewed by one of the nurses, who filled in the form. Two patients were telephoned some days later to get information as they had no

time to make the interview at the clinic.

Not all relevant injuries were identified. The main reason was due to the fact the interviewing personnel did not work 24 hour shifts. Their main working time was between 07.00 and 15.00 Monday through Friday. Some afternoons they were present until 23.00, and on some weekends.

After about eighteen months, 17 completed questionnaires on nail guns and 37 questionnaires on scaffolding injuries were collected; altogether 54 questionnaires. Only two refusals were reported. An analysis group was formed consisting of four experts, one labour inspector with specific experience on scaffolding, one organisational psychologist, and two of the authors: one safety professional (TL) and one injury researcher/ technologist (JL). Each group member filled in an analysis form for each questionnaire, see Box 3. A central part of the form was to identify deviances from regulations, instructions and

Box 1. General questions in the questionnaires for injuries with nail gun and scaffolding. An in-depth investigation in Trondheim, Norway, 2007-08.

1. Personal questions: age, sex, municipality of residence
2. Time of injury: Date, weekday, hour
3. Profession, trade (open question)
4. Level of education in the trade: apprentice, skilled, unskilled
5. Level of appointment: temporary, permanent, self-employed
6. Type of wages: piece wage, fixed wage
7. Length of time (days, weeks, months) worked on site when injury happened
8. How many hours at work the day injury happened?
9. How much experience (years) with the work (nail gun/scaffolding)?
10. What kind of education with nail gun/scaffolding?
11. Was this education useful in the work?
12. Did something extraordinary (out of the routine) happen with the nail gun/scaffolding when the injury occurred?
13. Did something extraordinary (out of the routine) happen with the working conditions when the injury occurred?
14. Were you pressed for time, e.g. short time limits?
15. Give a detailed and accurate description of what happened when the injury occurred
16. About the injury: body part injured, type of injury, in- or out-patient, if sick-leave, how many days, any permanent impairments?
17. Any proposals for prevention (improvements to equipment) to avoid similar injuries?

Box 2. Specific questions in the questionnaires for injuries with nail gun and scaffolding. An in-depth investigation in Trondheim, Norway, 2007-08.

For the nail gun

Between question 8 and 9 in Table 1:

N-1 What did you do with the nail gun when injury occurred: carried, started, worked with as usual, other?

N-2 If you worked as usual, did you keep the trigger mechanism depressed/locked while working?

Between question 16 and 17 in Table 1:

N-3 Which make, manufacturer, model of the nail gun?

N-4 Any deficiencies with the nail gun?

N-5 Level of maintenance: Good, poor

For the scaffolding

Between question 8 and 9 in Table 1:

S-1 During which part of the work with the scaffolding did the injury occur: while fitting up, during normal work on the scaffolding, during repairing or rebuilding the scaffolding, during dismounting of the scaffolding?

S-2 Total height of the scaffolding?

S-3 Was it a moveable scaffolding? If yes, were the wheels locked?

Between question 16 and 17 in Table 1:

S-4 Which make, manufacturer, model of the scaffolding?

S-5 What kind of material: steel, aluminium, wood, other?

S-6 Was the scaffolding wrongly mounted, defective or damaged in any way?

Box 3. Analysing form to be filled in for each questionnaire in an in-depth investigation in Trondheim, Norway, 2007-08.

Injury no. ..... Name of analyst: ..... Date of analysis:.....

1. The injury and injury event
a) What did the injured person do when the injury occurred?

b) How did the injury occur, what happened?

c) Machinery, tools or materials involved in the injury?

2. Deviance
Describe deviations from regulations, instructions, common practices.
Checklist of deviations (Kjellén 2000, p. 69):

Work situation:
- human error, e.g. wrong action, wrong sequence, omission
- technical failure, e.g. machine breakdown, missing equipment or tools
- disturbance in material flow, e.g. bad raw materials, delays
- Personnel deviations, e.g. absence, temporary personnel, indisposed
- Inadequate information, e.g. instructions, work permits

Environment:
- intersecting or parallel activities, e.g. other work team
- bad housekeeping
- disturbances from the environment, e.g. excessive noise, high temperature, snow/ice

Safety systems:
- failure of active or passive safety systems
- inadequate guarding
- inadequate personal protective equipment or clothes

3. Causal connections
What were the causes?

4. Suggestions for prevention
a) Immediate measures
b) Long term measures

5. Comments

common practice, as proposed by Kjellén [10]. A list of the deviances is given in Box 3. The analysis group discussed each form in order to develop a consensus on the assessment of risk factors. Preventive measures were not discussed. In average, about two man hours were used for each injury, including interviewing and analysis.

The expert group excluded two nail gun injuries. One of them was with a bolt gun and the other was a non-occupational injury. They also excluded nine of the injuries with scaffolding. These were either over-exertions or equipment that failed without relevance to the scaffolding. We were left with 15 injuries with nail gun and 28 related to scaffolding for risk factor analysis purposes.

The criterion for testing of relevance of each question (or data element) was if the answer given would point to a concrete and valid preventable risk factor, based on a subjective evaluation.

Result

Nail gun injuries

The workers involved in the nail gun injuries were 14 men and one woman. One of the men was Swedish. The others were Norwegians, mainly from the Trondheim area. The median age was 32 years, ages spanned from 18 to 57 years. Fourteen were injured in the arm/hand, 13 were stabbed. One was hospitalised. Three were certified for sick leave, two for three days and one for seven days. None of the 15 injured persons assessed their injury as causing permanent impairment.

Injuries related to scaffolding

The workers involved in the scaffolding material were 27 men and one woman. Two of the men were Swedish, five Polish and one Lithuanian. The median age was 26 years, ages spanned from 18 to 56 years. Fifteen of the injuries (54 %) were

Table 1. Frequencies of the values of the data elements similar for injuries with nail-gun and with scaffolding, an in-depth investigation in Trondheim, Norway, 2007-08.

Data elements in questionnaire	Nail-gun (15)	Scaffolding (28)	Relevance
1. Personal questions: age, sex, municipality of residence	See result section in text	See result section in text	M
2. Date for injury	N	N	N
2b. Weekday of injury	62% on Tues-/ Wednesday	54% on Tues-/ Wednesday	R?
2c. Hour of injury	08-11: 53% 12-15: 47%	08-11: 57% 12-15: 36% 16-19: 7 %	N
3. Profession, trade: carpenter C, scaffold fitter S, Other: O	C: 87% O: 13%	C: 43% S: 36% O: 21%	R?
4. Level of education	Skilled: 53% Unskilled: 27% Other : 20%	Skilled 50% Unskilled: 39% Other: 11 %	R?
5. Level of appointment: permanent employed P, temporary T, self-employed: S	P: 47% T: 33% S: 20%	P: 43% T: 50% S: 7%	N
6. Type of wages: fixed wage F, piece wage P, other: O	F: 60% P: 20% O: 13%	F: 93% P: 4% O: 4%	R?
7. Weeks worked on site when injury happened, min – max	0,2 – 32 Median 1,7	0 – 28 Median: 3	N
8. Hours at work the day injury happened? min-max	1-7,5 Median 4	1-12 Median 4	R?
9. Experience (years) with the work? min-max	0 – 30 Median 3	0 – 25 Median 3	N
10. What kind of education with nail gun/scaffoldings? School/course: S, from others: O, none/little: N	S: 33% O: 20% N: 40%	S: 54% O: 18% N: 25%	R?
11. Education useful in the work?	Many missing	Many missing	R?
12. Did something extraordinary happen with the nail gun/scaffolding?	Became part of description	Became part of description	R
13. Did something extraordinary happen with the working conditions?	Became part of description	Became part of description	R
14. Were you pressed for time, e.g. short time limits?	Yes: 7% No: 93%	Yes: 25% No: 68%	R?
15. Give a detailed description:	Became part of description	Became part of description	R
16. The injury: type, body part etc.	See result section in text	See result section in text	M
17. Any proposals for prevention?	Became part of description	Became part of description	R?

The relevance of the data elements for understanding/describing the material=M; for identifying risk factors=R; scarce understanding of risk factors=R?; not relevant data=N. (Sums of percentages in some cells are below 100%, mostly due to missing answers.)

caused by falls from scaffolding, three were falls on same level, seven were hit by or collided with objects, two incurred foreign body in an eye, and one was squeezed between objects. Nine were injured in the legs, nine in the body, five in the arm and five in the head. One was hospitalised. Nine were certified as eligible for sick leave, ranging from two through 14 days. None of the 28 injured persons assessed their injury as causing permanent impairment.

The injuries with scaffolding could be further subdivided in two groups with distinct variations in working activities:

1) injuries occurring when the scaffolding was fitted up, dismounted or repaired,
2) injuries occurring during normal work performed while on the scaffolding.

Frequencies of the values of the various data elements in the questionnaires are given in Table 1 and in Table 2.

Table 2. Frequencies of the values of the data elements special for injuries with nail-guns and/or with scaffolding, an in-depth investigation in Trondheim, Norway, 2007-08.

A. For the nail gun (N=15)

Data elements in questionnaire	Variations	Relevance
N-1What did you do with the nail gun when injury occurred: carried: C, started: S, worked as usual: U, other: O	U: 93% O: 7%	R?
N-2 If you worked as usual, did you keep the trigger mechanism depressed/locked while working?	Yes: 27% No: 47% Missing: 27%	R?
N-3 Which make, manufacturer, model of the nail gun?	Known 54% Unknown: 47%	R?
N-4 Any defectiveness with the nail gun?	Yes: 13% No: 87%	R?
N-5 Level of maintenance	Good: 87% Poor: 7%	R?

B. For the scaffolding (N=28)

Data elements in questionnaire	Variations	Relevance
S-1 During which part of the work with the scaffolding did the injury occur: while fitting up: F, during normal work on the scaffolding: N, during repairing or rebuilding the scaffolding: R, during dismounting: D	F: 29% N: 57% R: 4% D: 11%	M
S-2 The total height in meters of the scaffolding	0-4: 46% 5-20: 46%	R
S-3 Was it a moveable scaffolding? If yes, were the wheels locked?	Only one moving scaffolding, with locked wheels	M
S-4 Which make, manufacturer, model of the scaffolding?	Known: 57% Unknown: 43%	R?
S-5 What kind of material: steel: S, aluminium: A, wood: W	S: 61% A: 25% W: 4%	N
S-6 Was the scaffolding wrongly mounted, defective or damaged in any way?	Yes: 11% No: 68% Unknown: 21%	R?

The relevance of the data elements for understanding/describing the material=M; for identifying risk factors=R; scarce understanding of risk factors=R?; not relevant data=N. (Sums of percentages in some cells are below 100%, mostly due to missing answers.)

The relevance for understanding/describing the material (M) and identifying the risk factors (R) are given in the right column of the tables. Some variables were assessed to be of no relevance (N), as they did not point to any values that might indicate risk factors. Quite a few of the variables were assessed to indicate possible risk factors (R?), but require more detailed answers, or epidemiological studies of representative samples of workers using nail-guns or working on/with scaffolding.

Data elements important for revealing risk factors are above all the various narratives on how the injury occurred and circumstances surrounding them. In Table 3 and in Table 4 the risk factors identified are listed.

In some of the questionnaires (n=8) the information was too scarce to enable an understanding of why and how the injury occurred for identifying risk factors. All of these were injuries with scaffolding.

Design weaknesses with nail guns were the most important risk factors identified. Also weather conditions and foreign body to the eye were identified.

Risk factors related to the design of nail gun

In five of the nail gun injuries, the worker reported that the nail had hit a knot in the wood. Four of the workers reported the nail gun slipped, and one of the workers, a woman, reported that the pistol gun was heavy and asked for a lighter version of nail gun (Table 3). All of these injuries may be related to the design of the

Table 3. Risk factors identified in 15 in-depth investigations of accidents with nail gun in Trondheim, Norway, 2007-8.

Risk factor*	Accidents
Hitted knot in the wood	5
Nail pistol slipped	4
Nail pistol heavy (woman)	1
Possible risk factor, but require more information/studies	
No/scarce education/training	8
Possible time pressure	3
Total	**21**

*In some accidents more than one risk factor was identified.

nail gun.

Quite a few of the workers reported time pressure and lack of education. These variables should be studied epidemiologically in representative samples of workers for finding overrepresentations.

Time pressure

About one quarter (n=12) of the injured persons reported that time pressure was present in the working conditions when the injury occurred. This was more accentuated in regards to the scaffolding injuries (Tables 3 and 4). The dominance of this risk factor could not be assessed from the descriptions of these injuries.

Piecework contract might be one source of time pressure. In this material only four of the 43 injured workers reported they had such contracts, three of those worked with nail guns, and one worked on scaffolding. For three of these injuries, time pressure was mentioned as a risk factor.

Lack of education

About one third of the injured workers answered they had no or little education with either operating nail guns (n=8) nor with scaffolding (n=6).

Three of the eight workers with nail guns had no education and training, two got five minutes of instruction, one reported "little", one got some training from colleagues and one received guidance from the foreman.

Of the six scaffolding workers with no or little education, three were working on the scaffolding when the injury occurred. The other three were working with fitting up, dismounting or repairing the scaffolding, of these, two of the scaffoldings had a height above five meters. According to the Norwegian regulation, fitting up and dismounting scaffoldings with a height above five meters requires 36 hours of theoretical education, 72 hours of practical exercises and at least six months of practise under supervision using scaffoldings at job sites.

Table 4. Risk factors identified in 28 in-depth investigations of accidents with scaffoldings in Trondheim, Norway, 2007-8.

Risk factor*	Accidents**	
	A	B
Snow and ice	1	2
Foreign body in eye	2	
Lack of control/inspection of scaffolding when erected		2
Over-exertion	1	
Possible risk factor, but require more information/studies		
Possible time pressure	6	3
No/scarce education/training	3[1]	3
No risk factor identified due to too little information	2	6
Total	**15**	**16**

*In some accidents more than one risk factor was identified.
**Type A: 12 accidents when fitting up, dismounting or repairing the scaffolding; Type B: 16 accidents during normal work on the scaffolding.
[1]Two of these accidents occurred at scaffoldings with heights above 5 meters. According to Norwegian regulation, working with such scaffoldings requires education.

Relevant questions for identifying risk factors

From Table 1 and 2 quite a few of the data elements are considered to be of no relevance for our identification of risk factors, or are data elements that require more information or representative samples.

The relevant questions are above all those related to the narrative; how the injury occurred, if special conditions were involved, also to some extent proposals of how such injuries might be prevented.

Discussion

We have studied occupational injuries with nail guns and scaffolding with mainly qualitative methods, in order to identify concrete risk factors which in turn will enable suggestions for preventive measures. The identification of risk factors was done by means of interviews conducted of injured persons recruited at an out-patient clinic just before or after their treatment.

Risk factors

Nail gun. The trigger mechanism on nail guns operates in combination with a contact element located in the nose of the gun. For older models, it is possible to fire nails the entire time the nose is depressed, thus enabling rapid fire. In newer models, the nose element has to be depressed each time before the trigger is activated in order

for the gun to fire. This design ("sequential trigger") decreases unintentional firing, thus preventing injuries [11, 12].

Upon being asked for the model of nail gun in the questionnaire (Box 2, question N-3), the workers could not identify the type of trigger mechanism. In one of the injuries, the worker stated that the injury would have been prevented if his nail gun had been of the sequential trigger design. For most of the other injuries, the descriptions seem to indicate that the trigger design was irrelevant for the injury, e.g. the nail hit a knot or the nail gun slipped.

Quite a few of the injuries occurred when the nail hit a knot in the wood. In the Nordic countries, building materials from softwood timber (with a lot of knots) are quite common. This material is less suited for gun pistols then chipboard

Weather conditions and foreign body to the eye appear similar to one another in that they entail a failure to intervene with preventive measures (clearing away snow and ice, using protective eyewear, etc.), a decision that the worker him/herself has influence over.

Time pressure. In the study of 50 severe occupational injuries in the building industry [6], time pressure was found to be a factor in more than a third of the injuries. The injury descriptions and risk factors were described in more detail due to a more thorough investigation method than in this study.

Methodological considerations and limitations

In the present study, we have identified risk factors based on only one or a few injuries. Similar in-depth investigations on few injuries and injuries have been implemented, and all provided knowledge about risk factors in injuries [4]. One of the aims of the present study was to identify risk factors involved in certain occupational injuries, but not necessarily to generalise to the population of occupational workers. To do so, epidemiological studies with higher number of injured workers in representative studies are necessary. Our method is based on the assumption that a risk factor identified in one injury, might be found in other injuries of the same type [13]. If we are able to remove or diminish this risk factor in question, same type of injuries might be avoided in the future.

The method used in the present study might be compared with investigations of single injuries with many fatalities, e.g. airplane crashes, ship disasters, train injuries. In such cases, an investigative body is established comprised of experts on various aspects of injury scenario, and significant investigation resources are expended in the process (mainly due to the catastrophic character of the injury). The expert group in the present study will similarly consist of persons of varied expertise in order to cover the main aspects of these injuries. The composition of the group will influence the process of identifying risk factors. The group members should have experience with and knowledge of the conditions of the working process and the labour market in order to identify risk factors for developing preventive measures. They should also assess the validity of the injury descriptions, which in the present study is based on the workers own descriptions [14].

To recruit injured patients for research studies or in-depth investigations from out-patient clinics is particular challenging due to the nature of the clinical settings and of the patients that present to the clinic [15].

Close cooperation with management and staff of the out-patient clinic is necessary to minimize such problems. Conforming to privacy legislation and ethical requirements is also important. Participation in our study was based on agreement from the injured persons.

Interviews in our study were made by health personnel, with little training and without expertise of the occupational and technical aspects of the injuries. Some injury descriptions were therefore scarce with regard to these aspects. Interviewers might have been able to collect more detailed information if training had been more extensive. In addition, interviewers could have used pictures describing different types of nail-guns to assist patients with identification. However, for this data element, studies of greater samples would be necessary to identify specific models having higher injury rates than others. Questionnaires concerning six workers from Eastern Europe (of a total of 43) had too little information, probably due to language problems.

For future in-depth investigations of this nature, we recommend that the injured workers are interviewed by a specialist on a particular injury type, such as a senior labour inspector. Studies of injuries in the building industry in the USA have utilised safety professionals or supervisors to perform similar interviewing at the work place [16, 17], giving deeper understanding of the risk factors and the context in which the injuries occur than obtained by conventional interviews conducted by administrative staff. In some of these interviews, the Haddon matrix

[18] was used for structuring the questions into four categories: human, object, environment and organisation.

In the present study we used a form for analysis, as proposed by Kjellén [10] to identify deviations from regulations, instructions and common practice. This form did not bring as many deviations as anticipated, due to the lack of information in narratives, as well as lack of interviews being carried out at the workplace. In the in-depth investigation of 50 occupational injuries in the building industry with severe injuries [6], half of the injuries were studied on site with interviews of co-workers and foremen, and pictures were taken. A number of deviations were identified, requiring half a day to conduct these interviews, compared with 15 minutes for each interview in the present study.

One aim was to find a less time-consuming method than the one utilised by Gravseth et al, but which nevertheless would identify preventable risk-factors. In the present study, seven concrete and two possible risk factors were identified in a study of 43 injuries. Gravseth et al identified 42 concrete risk factors in a study of 50 injuries. However, these 50 injuries were rather different types of injuries: electrical, injuries with lifts, scaffolding, ladders, electrical tools, nail guns etc., while the present study was limited to injuries with nail gun or scaffolding. If the present study had investigated other injury types as well, it would be logical to suggest that more risk factors would have been identified.

Although only 15 minutes were necessary for each interview at the out-patient clinic, the interviewers had to be present the entire day in order to obtain the relevant interviews. These persons were engaged in the evaluation of the first step of the injury registration system, the monitoring, and used their spare time in the interviews. If they had been engaged for the interviews only, the cost per interview would have risen considerably.

The advantage for using the health system is that the time window between the injury and the interview is very short. Another advantage is that the coverage rate of the injuries is very high in the health system. It is much more efficient to ask questions of workers arriving for treatment than attempting to conduct interviews at the various workplaces or by means of the Norwegian official occupational injury register with its low coverage rate and rather high reporting delays.

In the present study, all workers were interviewed at the out-patient clinic. Two of them were interviewed by telephone to gain additional information. An alternative approach could be to ask relevant injured workers at the out-patient clinic to sign a declaration stating that they are willing to be contacted at a later time by telephone regarding the injury, as was done in a similar project in Denmark [19]. The interview could then be conducted by a person with insight into both the working processes and the injury type in question in order to get as much information as possible from the worker with regards to the identification of risk factors. In addition, the workers could be requested to grant permission to carry out an on-site investigation, if resources were available. Such a method would minimise the need to have interviewers permanently present in the out-patient clinic during day-time working hours.

We have seen that the descriptions of how the injury occurred and if something extraordinary occurred were of significant importance for the identification of risk factors. Collection of a detailed narrative concerning the injuries and the surrounding circumstances appears to be valuable for the identification of risk factors [20,21]. Suitable software has now been developed for analysing such narratives [21].

Conclusions

With the present method some risk factors were identified, such as design weaknesses of nail guns, snow and ice, foreign bodies in the eye and lack of control/inspection of scaffolding when erected. On average, about two man hours were used for each injury. The most relevant questions were those related to the narrative, in particular, how did the injury occur, and if some special conditions were involved. Quite a few of the data elements require epidemiological representative studies in order to assess them as potential risk factors. This relatively low time-consuming method could be more effective if the interviews were conducted by telephone a few days after treatment by a specialist in that particular injury type, such as an experienced labour inspector, in order to delve more deeply into the technical risk factors.

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Ethical approval

No medical information was collected about the patients. They all gave informed consent. Due to these circumstances, the secretariat for the regional ethical committee assessed that this project did not to need to be considered in the committee.

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